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GENERAL NOTES.

The Committee on Publication has decided to conduct a new department in the *Publications* under the title given above. Many notes of a general character have appeared in the Notices from the Lick Observatory, but hereafter notices in that department will be confined to accounts or results of investigations being carried on in that institution. Members and friends of the Society are invited to aid the committee in carrying out the work of this new department. Communications of general interest will be gladly received and may be sent to SIDNEY D. TOWNLEY, 2023 Bancroft Way, Berkeley, California.

Through the courtesy of Professor A. O. LEUSCHNER, of the University of California, we are able to reproduce as our frontispiece, a photograph of the new observatory at Potsdam. The building contains the new refractor, the object-glasses of which were cast by SCHOTT in Jena, and ground by C. A. STEINHEIL SONS in Munich. The photographic objective has an aperture of 80^{cm} (31.5 inches) and focal length of 12 meters, while the visual has an aperture of 50^{cm} and focal length of 12½ meters. The mounting was made by A. REPSOLD & SONS. The instrument is to be used principally for the determination of radial velocities of the stars. The dedication of the new observatory was held, amid elaborate ceremonies attended by the Emperor, on the 26th of August of the present year.

The *Scientific American* for November 4, 1899, contains an illustrated article on the great telescope being constructed for the Paris Exposition. The objective is 4.1 feet in diameter, and weighs 1,295 pounds. A photographic objective of the same size has also been made. .The discs were cast by MANTOIS and the grinding was done by GAUTIER. The telescope tube, 197 feet in length, is to be mounted in a stationary horizontal position, and the light is to be reflected into the objective by means of a huge plane-mirror to be driven by clockwork. The mirror is 6.56 feet in diameter, 10.63 inches thick, and weighs 7,920 pounds. The glass was cast at the Jenmont Works, and one of sufficient size was obtained only after several trials. The grinding and polishing consumed ten months. The operation is a most delicate one on account of the heat produced in the process. The mirror and its mounting weigh 99,000 pounds, and a weight of 220 pounds is necessary to run the clock.

The number of students in the astronomical courses at the University of California has increased so largely that it has become necessary to build an addition to the Students' Observatory. This will be a lecture-room, with a rising floor and a seating capacity of 135. The total enrollment in the astronomical courses this semester is 137, representing 109 different students, of whom eight are graduate students.

In a short article on the transit-micrometer, in No. 470 of the *Astronomical Journal*, Mr. A. S. FLINT, of the Washburn Observatory, remarks as follows: "The performance of this transit-micrometer in general has been very satisfactory. As shown by the experience of European observers, this device reduces the differences of personal equation between observers to a small fraction of their value under the old method, and it is expected that it will also avoid practically variations of personal equation in the same observer." It is to be hoped that this simple and practical device may soon be universally adopted for meridian-circle work; for there is scarcely any longer a doubt that it almost eliminates the personal equation, which has always been such a troublesome factor in meridian-circle observations.

In the November number of *Popular Astronomy*, Professor FRANK H. BIGELOW contributes an article under the title, "Result of the Observations of the Weather Bureau for the Probable Cloudiness of the Sky along the Path of the Total Eclipse of the Sun, May 28, 1900." Observations of the general cloudiness and clouds in the neighborhood of the Sun were carried out by the Weather Bureau at various stations along the path of totality, from May 15th to June 15th, during the years 1897, 1898, and 1899. The result of the observations is that the cloudiness is least in Georgia and Eastern Alabama, increasing in either direction, and greater on the Atlantic Coast than in the region of the Gulf of Mexico. A detailed statement of the conditions existing at the various cities and villages is also given.

The article closes with the following statement: "The Chief of the Weather Bureau sent a circular letter to a number of towns located near the central line, requesting replies to several questions of interest to astronomers, in order that such practical information might be furnished them regarding the locality as would assist in deciding upon the best sites. The questions concern the latitude, longitude, altitude, population, accommodations, railroads, topography, eastern horizon, wind, and drift of smoke, and suggestions regarding good sites accessible to heavy baggage. The replies of thirty-seven places are summarized in the report of the Weather Bureau for 1899, to which those interested are referred. The astronomers of the United States and foreign countries will appreciate the assistance which so many volunteer observers have cheerfully rendered in making this survey as complete as possible."

The library of the Society has recently received a copy of the Indian Eclipse, 1898, being a report of the expeditions organized by the British Astronomical Association to observe the total solar eclipse of 1898, January 22d, edited by E. WALTER MAUNDER, F. R. A. S. The book is profusely illustrated with cuts of superior excellence. Several reproductions of photographs of the corona and spectra are given, but the majority of the cuts are of observing-stations, instruments, drawings of corona, and a variety of Indian scenes. Among the cuts are two of Professor CAMPBELL'S station at Jeur. "The Lick camp was conspicuous by the long forty-foot telescope, which, with its end planted in a pit some eight feet deep, shot up into the air above the tree-tops. A marked feature, too, was the Stars and Stripes, which, supported by the Union Jack, very appropriately floated above the *chupper* roof of their banqueting-hall. It was a sign of good feeling and comradeship which characterized the whole intercourse between the camps. In the shadow of the gigantic tube, and looking quite dwarfed beside it, were the Professor's other instruments for spectrum photographs and smaller coronal images. The great telescope gave a disc of nearly five inches in diameter, the largest obtained in the camp. But it is interesting to note that the astronomers were not too proud to use the humbler and smaller every-day camera for snap-shots—all were pressed into service." A description is given also of Professor BURCKHALTER'S equipment. On page 50 is the following: "Our American friends rather astonished the natives, for there was nothing they could not do, and did not do, with their own hands—from driving a screw or sawing a plank to the most delicate adjustments of their instruments. Visitors might have passed them by at their work in looking for more presentable professors. Having brought their own tools and implements, they were certainly independent of the village carpenter." It is barely possible also that the natives were not the only surprised ones.

In the last chapter a summary of results and suggestions for future work are given.

SUMMARY OF RESULTS.

1. The spectrum of the "Flash" has been successfully photographed on five plates.
2. A new region of the "Flash" spectrum has been explored and mapped.
3. The bright line spectrum of hydrogen has been followed in the chromosphere to the thirtieth point of the series, and the wave-lengths are shown to agree closely with BALMER's formula.
4. The correction to the received wave-length of the "coronium" line detected by Mr. FOWLER has been confirmed.
5. The distribution of "coronium" in the corona has been examined.
6. Several drawings of the corona as seen by the unaided eye have been made.
7. The variation of the form of the corona with the sun-spot cycle has been further illustrated.
8. Twenty-eight photographs of the corona have been taken.
9. These include several showing the coronal rays to a greater distance from the Sun than they have ever been photographed before.
10. And cast fresh light upon their structure.
11. Beside restoring the credit of many old drawings of eclipses, which had been supposed untrustworthy because of their want of resemblance to the photographs.
12. The wide range of exposures employed furnishes a most valuable guide as to the exposures to be employed in future eclipses.
13. The corona has been definitely photographed during the partial phase.
14. In several different and independent ways a measure has been obtained of the total illumination given by the corona.

The suggestions for work in future eclipses are given under the following headings: Drawings of the Corona; Spectroscopic Observations; Proper Exposures for Photographs of the Corona; Photographs during the Partial Phase; Determination of the Brightness of the Corona.

The suggestions there made are well worth the consideration of persons who expect to observe the eclipse next May.

The Board of Visitors to the United States Naval Observatory appointed by Secretary LONG last spring met at the Observatory in Washington on June 30, 1899, and submitted their report on October 2d. The members of the Board were: the Hon. WILLIAM E. CHANDLER, the Hon. ALSTON G. DAYTON, and Professors EDWARD C. PICKERING, GEORGE C. COMSTOCK, and GEORGE E. HALE.

The report is divided into eight sections, as follows:—

I. Recommendation of the Board of Visitors.
II. Circumstances leading to the appointment of the Board of Visitors.
III. Cost of the Observatory.
IV. Comparison with other observatories.
V. Present condition and methods of observatory work and the delay in printing its results.
VI. Historical sketch of the Observatory.
VII. Minutes of the proceedings of the Board of Visitors.
VIII. Appendix.

Section I was printed in full in the November numbers of *Popular Astronomy* and the *Astrophysical Journal*. Its essential points are given in the following extracts. Sections II, III, and IV, which we print below, were kindly communicated by one of the members of the Board of Visitors.

RECOMMENDATIONS OF THE BOARD OF VISITORS.

. . . "The Naval Observatory, which was originally established as a scientific bureau, auxiliary to the needs of the naval service, has become through half a century of growth, and through the expenditure of large sums of money, as authorized by law, an astronomical observatory of the first rank in respect of buildings, instruments, and equipment. But by far the larger and more valuable part of its equipment has little or no reference to any direct requirement of the naval service, and its existence can be justified only on the ground that Congress has intended to establish and maintain a national astronomical observatory. Under these changed circumstances its continued connection with the Navy Department has seemed to many of those whose views have been submitted to the Board of Visitors, illogical and undesirable. In view, however, of the absence of a national university, a department of science and industries, or other department or bureau of the Government especially suited to the conduct of such scientific work, and in view of the diversity of opinion among American astronomers upon the question to which existing department the observatory could be wisely transferred, we believe it to be inexpedient for us at the present time to further consider the subject of such transfer. . . .

" If the observatory, as a shore station charged with the performance of certain functions assumed to have a relation to the navy, is to continue under the command of a line officer, we recommend that the astronomical staff of the Naval Observatory shall consist of an astronomical director, four astronomers, three assistant astronomers, and such computers and other minor officers as may be provided by law. The astronomical director and astronomers, whether professors of mathematics or taken from civil life, and the assistant astronomers, should be appointed by the President, by and with the advice and consent of the Senate, to hold their offices until their successors are appointed.

"The Nautical Almanac office, which was formerly a distinct bureau, is now administered by departmental regulation as a part of the Naval

Observatory, and it appears from the evidence submitted to the Board of Visitors, that a successful administration of the observatory is much impeded by reason of imposing upon its astronomical director the duties of director of the Nautical Almanac. Each of these offices furnish abundant employment for the entire time of an able astronomer, and we therefore recommend that there shall be a director of the Nautical Almanac appointed by the President, by and with the advice and consent of the Senate, to hold office until his successor is appointed. . . .

"There shall be appointed by the President, from persons not officers of the United States, a board of nine visitors to the Naval Observatory, six to be astronomers of high professional standing, and three to be eminent citizens of the United States. Appointments to this board shall be made for periods of three years, but provisions shall be made by initial appointments for shorter terms, so that two astronomers and one member of the board not an astronomer shall retire in each year. Members of this board shall serve without compensation, but the Secretary of the Navy shall pay the actual expenses necessarily incurred by members of the board in the discharge of such duties as are assigned them by the Secretary of the Navy, or are otherwise imposed upon them. . . .

"If astronomers are appointed to the Naval Observatory from civil life to succeed retiring professors of mathematics, the salaries provided should be sufficient, as recommended by you in that report of 1897, 'to make up for the refusal to them of the privilege of retirement, and also to secure men of high scientific attainments adequate to the demands of one of the most capable observatories of the world.' To secure the services of the ablest astronomers the salaries provided should be slightly larger than those paid in the higher class of university observatories, and account should be taken of the fact that university vacations are much longer than leaves of absence from public service. The Board of Visitors recommends the following as a schedule of salaries which could be expected to attract astronomers of the class desired: Astronomical director, $6,000; director of Nautical Almanac, $5,000; first astronomer, $4,000; second astronomer, $3,600; third astronomer, $3,200; fourth astronomer, $2,800; first assistant astronomer, $2,400; second assistant astronomer, $2,200; third assistant astronomer, $2,000.

"The experience of every great observatory shows that the efficiency of its staff is materially increased by the provision of quarters near the observing-room for those persons who are engaged in work by night, and we recommend that there should be quarters provided upon the observatory grounds for all members of the astronomical staff regularly assigned to night work.

"In concluding its recommendations, the Board of Visitors wishes earnestly to urge upon your consideration the necessity of making a success of the movement which you have begun in order to improve the condition of the Naval Observatory and to make its administration satisfactory to the great body of astronomers, of the country and to the public.

"Some of our recommendations, if they meet your approval, can be carried into effect by departmental action; but the changes which we regard as vital can only be obtained through legislation by Congress. If such legislation is withheld, the continuance of present conditions is sure to result in a renewed, persistent, and possibly acrimonious demand for the removal of the observatory from naval command. If, however, the legislation is enacted, and the improved system is given a fair trial, unquestionably much improvement will result, and it is not improbable that the observatory will attain and hold that high standing in the scientific world which should be required of such an institution." . . .

REPORT OF COMMITTEE OF ASTROPHYSICAL CONFERENCE.

"At the Harvard Astronomical Conference, held in Cambridge, on August 18, 1898, the undersigned were appointed a committee to consider what changes, if any, were advisable in the organization of the United States Naval Observatory. A circular was sent to the principal astronomers in the United States, asking six questions regarding means of increasing its astronomical efficiency. Sixty-one replies were received, with the following approximate results, doubtful answers being counted as one half:

1. A change in organization is recommended. 51 to 2.
2. The entire direction of the observatory should be intrusted to an astronomer. 54 to 3.
3. Transfer of the observatory to some other department of the Government. 19 to 19.
4. Separation from the observatory of various branches, such as the testing of nautical instruments. 26 to 24.
5. Tenure of office and advancement should depend on scientific efficiency, rather than upon age or length of service. 50 to 2.
6. A Visiting Committee should be appointed. 43 to 6.

"It therefore appears that opinion is nearly equally divided whether a portion or the whole of the observatory should be transferred to some other department, but is nearly unanimous in favor of changing the present organization, of intrusting the entire direction to an astronomer, of making advancement depend on scientific efficiency, and of appointing a Visiting Committee. To be efficient this committee should have power to act, and should consist of experts who would serve without pay.

"In March, 1899, the Secretary of the Navy decided to create the present Board of Visitors to the Naval Observatory.

"COST OF OBSERVATORY.—The financial condition of the observatory is shown in the Appendix, Exhibit H, which gives the total cost of grounds and buildings to July 1, 1899, to be $473,200; estimated value of the grounds, buildings, and instruments, $856,547.35; annual appropriations for the year ending June 30, 1899, $51,160; and annual appropriations for grounds and roads for the same year, $11,200. To the current expenses of $51,000 should be added several items, really paid for by the Government but not included in the above appropriations. Their amounts will vary from year to year, and can only be estimated approximately. They include,—

"First, the salaries of the Superintendent and other line officers detailed for duty at the observatory; estimated amount, $6,000.

"Second, salaries of professors of mathematics. There are now five of these at the observatory besides one temporarily ordered to the Bureau of Yards and Docks; estimated amount, $15,000.

"Third, retired pay of professors of mathematics who served as astronomers; estimated amount, $10,000.

"Fourth, cost of printing publications; estimated amount, $3,000.

"According to these estimates, the total annual cost to the Government exceeds $85,000, not including expenditures for the Nautical Almanac. In any plan for reorganization the sum of $85,000 annually should therefore be assumed as that available, unless it is the intention of Congress to reduce the expenses rather than to increase the amount of useful work accomplished.

"COMPARISON WITH OTHER OBSERVATORIES.—From a comparison of the resources of the Naval Observatory with those of the principal observatories of the world, it appears that the observatories having the largest annual incomes are as follows: Naval Observatory, $85,000; Paris, $53,000; Greenwich, $49,000; Harvard, $46,000; Pulkowa, $46,000; Cape of Good Hope, $33,000. The resources of some of the richest private observatories are not published, but it is probable that none of them would exceed those of the Cape Observatory. The incomes of the greater portion of the observatories of the world, both public and private, are far less than those mentioned above.

"The work of the Greenwich Observatory may fairly be compared with that of the Naval Observatory, since both institutions are supposed to cover nearly the same field. It might well be asked whether the Naval Observatory, with much greater resources than the Greenwich Observatory, furnishes contributions to astronomy of equal value.

"The conditions for scientific work in Europe are, however, so different from those in America that it is more instructive to compare the details of organization with those of an American observatory. The Harvard Observatory is selected for three reasons: First, both institutions undertake large pieces of routine work which are beyond the reach of the smaller observatories. In this respect they differ from the other American observatories, whose officers are mainly specialists engaged in individual research. Secondly, the resources of the Harvard Observatory approach more nearly than do any other those of the Naval Observatory. Thirdly, all details of the Harvard work are readily available.

"*Grounds.*—The Naval Observatory grounds cover seventy acres, valued, with the improvement made of the grounds, at $66,000. The Harvard Observatory grounds cover seven acres, having an estimated value of $50,000. These last grounds are too small and too near thickly settled portions of the city. The climates of Washington and Cambridge are not suitable for astronomical observations of the highest grade. Harvard has established a secondary station in Arequipa, Peru, at a height of 8,000 feet, selected after careful study as the location in which the atmospheric conditions are more favorable than had been found in any other part of the world. Six meteorological stations, extending from the sea-level to a height of 19,200 feet are associated with it. The observatory is also closely related with the Blue Hill Meteorological Observatory, which is not included in the present discussion.

"*Buildings.*—The buildings of the Naval Observatory are valued at $457,512.83; those at Cambridge, at $52,000; and those at Arequipa, at $12,000. The Harvard buildings are very inadequate, and for the most part are not fire-proof.

"*Instruments.*—The principal instruments at the Naval Observatory are the twenty-six-inch equatorial telescope, the twelve-inch equatorial telescope, the nine-inch transit-circle, the six-inch transit-circle, the five-inch altazimuth, and the prime vertical transit instrument. In general, the work done with these instruments does not differ from that done elsewhere. The nine-inch transit-circle is not now in use, but in the past it has done useful work, including the observation of one of the international zones. The principal Harvard instruments at Cambridge are the fifteen-inch equatorial telescope, the fifteen-inch reflector, the twelve-inch meridian-photometer, the eleven-inch Draper telescope, the eight-inch transit-circle, the eight-inch Draper doublet, the six-inch equatorial telescope, and the four-inch transit-photometer. The principal instruments at Arequipa are the twenty-four-inch Bruce doublet, the thirteen-inch Boyden, visual and photographic, equatorial telescope, the eight-inch Bache doublet, the four-inch meridian-photometer, and the four-inch transit-photometer. The eight-inch transit-circle is not now in regular use, but with it two of the international zones have been observed. All of the other instruments are in regular use every clear night, nearly all of them until dawn, and the work done with them is not duplicated elsewhere.

"*Permanence of Direction.*—Each piece of work undertaken at a large observatory should extend over several years, and in some cases indefinitely. Changes greatly diminish the value, and should be made only when absolutely necessary. Continuity of work is best secured by long tenure of office of the executive officer. At the Naval Observatory ten Superintendents have held office during the last thirty-three years, not including those serving *ad interim*, the average term being three years and one third. Some of these served two or three times, with intervals filled by other officers. (See Appendix, Exhibit I.) The rules of the service render difficult the long continuance of an efficient officer on shore duty. The Greenwich Observatory, established in 1675, has had eight directors in two hundred and twenty-four years, the average term being twenty-eight years. The Harvard Observatory, established in 1840, has had four directors in fifty-nine years, the average term being fifteen years. Of these two institutions, nine of the directors have died in office, one retired at the age of eighty years, and none of them have ever resigned to accept positions elsewhere.

"*Salaries.*—The principal item in the expenses of an active observatory is the salaries of its officers. For the Naval Observatory this item amounts to five sixths of the entire expenditure. It is, therefore, of importance to compare the scale of salaries and the proportion of high and low grade officers. The approximate number of persons of various grades and their average salaries at the Naval and Harvard Observatories are given below:—

	Naval Observatory.		*Harvard Observatory.*	
Directors	2	$4,000	1	$5,000
Astronomers	4	3,000	6	2,000
Assistant Astronomers	3	1,900	13	900
Computers	8	1,200	18	600
Skilled Artisans	6	1,200	1	700
Laborers	20	700	3	600
	43		42	

It should be stated, however, that some of the assistants at Harvard devote only a portion of their time to this work and receive proportional salaries, the effect not being sufficient to materially alter the conclusions.

"The dual head of the Naval Observatory is, of course, the most striking feature in this comparison. This alone gives an undue cost to the management of the Naval Observatory. The salary of the Astronomical Director is small, considering the importance of the position. As he is a professor of mathematics, his salary may be $2,400, $2,800, $3,200, or $3,500. The Superintendent, in addition to his salary, has the use of a suitable house. A house is provided for the Director at the Harvard Observatory, but the rent is deducted from his salary. It has not been customary for the Superintendent of the Naval Observatory to take part in the scientific work of the institution and the Astronomical Director does not make observations. The Harvard directors, in addition to their work in the day-time, have always taken part in the observations, the work for the last twenty years averaging over four hours on every clear evening.

"In nearly all military and civil establishments the officers of low grade are much more numerous than those of high grade. There are many more captains than admirals. At the Naval Observatory this difference is much less than at Harvard. At both institutions the observations consist mainly of large pieces of routine work. These are planned by the directors and astronomers, who may also make the observations; but the great labor of computation and reduction is done by the assistant astronomers and computers. The latter can do as much of this work, which is often mere copying, as officers receiving much higher salaries, and it will be noticed that their number at Harvard (thirty-one) is nearly three times that at Washington (eleven). The naval appropriations provide for an instrument-maker, an electrician, a photographer, a carpenter, an engineer, and a skilled laborer. At Harvard there is one instrument-maker, who, however, has a machine-shop. No adequate shop is provided at Washington. The photographic and similar work at Cambridge is done mainly by the assistant astronomers and computers. Ten of the laborers at Washington take care of the grounds, which are ten times as extensive as those at Cambridge. The large number of watchmen (six and a captain of the watch) is perhaps justified by the value of the property to be guarded. The great difference in salaries at Washington and Cambridge, especially for the officers of lower grade, is probably unavoidable. This is partly due to civil-service rules, which, as sometimes administered, also render it difficult to discharge a man who proves to be unfit for his position. The alternative of political appointments would however be fatal to the scientific usefulness of the institution.

"It is evident that the liberal appropriations made to the Naval Observatory should render it the greatest observatory in the world. The principal hindrances, as compared with other observatories, seem to be: (1) The relation of the observatory to the Government, which makes its management complex; (2) frequent changes in its executive officer, which renders a policy of long continuance difficult; (3) the salaries must be much higher than in private institutions to secure equally good men; (4) promotions in cases of special skill, and removal in cases of inefficiency, are difficult; (5) specific expenditures must be provided for in advance, and cannot be changed if conditions alter. Many of these difficulties would be diminished with an efficient and active executive, thoroughly familiar with the scientific work of the institution and having power to enforce needed reforms. A Board of Visitors, independent of Government control, but having power to make necessary changes, would greatly aid such an executive."

The Board of Trustees of the University of Indiana have decided to build an observatory, the principal instrument of which is to be a first-class twelve-inch refractor.